

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) An X-ray diffraction method for the analysis of polycrystalline materials, the method comprising:
 - (a) providing a polycrystalline material for analysis;
 - (b) providing a polychromatic X-ray source, wherein the source produces X-rays by accelerating charged particles to energies of no more than 1 MeV;
 - (c) collimating X-rays from the polychromatic X-ray source into a beam having a divergence in the range of from 10^{-4} to 10^{-2} radians;
 - (d) exposing at least a portion of the polycrystalline material to the collimated X-ray beam, whereby the beam is diffracted;
 - (e) collecting at least some of the diffracted X-rays in an energy dispersive X-ray detector or array; and
 - (f) analysing the collected, diffracted X-rays to map the lattice parameter in the polycrystalline material.
2. (Original) A method as claimed in claim 1, wherein the source produces X-rays by accelerating charged particles to energies of no more than 500 keV.
3. (Previously presented) A method as claimed in claim 1, wherein the energy dispersive X-ray detector has a relative energy resolution of from 0.5×10^{-2} to 5×10^{-2} .
4. (Previously presented) A method as claimed in claim 1, wherein the energy of the collimated X-ray beam is ≥ 60 keV.
5. (Previously presented) A method as claimed in claim 1, wherein the collimated X-ray beam penetrates the polycrystalline material to an attenuation depth of ≥ 1 mm.

6. (Previously presented) A method as claimed in claim 1, further comprising moving the collimated X-ray beam relative to the polycrystalline material.
7. (Original) A method as claimed in claim 6, comprising scanning the collimated X-ray beam across at least a portion of the polycrystalline material, while keeping the polycrystalline material stationary.
8. (Previously presented) A method as claimed in claim 1, wherein the collected, diffracted X-rays are analysed in order to determine a structural and/or chemical characteristic of the polycrystalline material.
9. (Original) A method as claimed in claim 8, wherein the structural characteristic is the lattice parameter.
10. (Original) A method as claimed in claim 9, wherein lattice parameter determination is used to provide information on phase distributions, stresses and/or strains in the polycrystalline material.
11. (Original) A method as claimed in claim 10, wherein lattice parameter determination is used to map phase distributions, stresses and/or strains in the polycrystalline material.
12. (Original) A method as claimed in claim 11, wherein lattice parameter determination is used to map phase distributions, stresses and/or strains in the polycrystalline material at a depth of ≥ 1 mm.
13. (Previously presented) A method as claimed in claim 1, wherein the polycrystalline material is an engineering article or component part thereof.
14. (Previously presented) A method as claimed in claim 1, wherein the polycrystalline material comprises a metal or alloy, ceramic or crystalline polymer, including combinations of two or more thereof.

15. (Previously presented) A method as claimed in claim 1, wherein the polycrystalline material is a composite material comprising a crystalline phase.
16. (Original) A method as claimed in claim 15, wherein the metal matrix composite material is a glass and/or ceramic reinforced metal matrix composite material.
17. (Previously presented) A method as claimed in claim 1, wherein said portion of the polycrystalline material has a thickness of ≥ 1 mm.
18. (Currently amended) An apparatus for X-ray diffraction analysis of polycrystalline materials, the apparatus comprising:
 - (i) a polychromatic X-ray source, wherein the source produces X-rays by accelerating charged particles to energies of no more than 1 MeV;
 - (ii) means for collimating X-rays from the polychromatic X-ray source into a beam having a divergence in the range of from 10^{-4} to 10^{-2} radians;
 - (iii) an energy dispersive X-ray detector or array for collecting at least some of the diffracted X-rays resulting, in use, from exposing at least a portion of a polycrystalline material to the collimated X-ray beam; and
 - (iv) means for analysing the collected, diffracted X-rays to map the lattice parameter in the polycrystalline material.
19. (Original) An apparatus as claimed in claim 18, wherein the polychromatic source is moveable with respect to a polycrystalline material to be analysed.
20. (Previously Presented) An apparatus as claimed in claim 18, wherein the collimated X-ray beam is adapted, in use, to scan, across the polycrystalline material, while the polycrystalline material is maintained stationary.
21. (Original) A method of quantitatively mapping the sub-surface distribution of the crystal lattice parameter in a polycrystalline material, the method comprising:
 - (a) providing a sample for analysis, wherein the sample comprises a polycrystalline material;

- (b) providing a polychromatic X-ray source, wherein the source produces X-rays by accelerating charged particles to energies of no more than 1 MeV;
 - (c) collimating X-rays from the polychromatic X-ray source into a beam having a divergence in the range of from 10^{-4} to 10^{-2} radians, and a penetration depth of ≥ 1 mm;
 - (d) scanning the collimated X-ray beam across the sample, whereby the beam is diffracted;
 - (e) collecting at least some of the diffracted X-rays in an energy dispersive X-ray detector or array; and
 - (f) analysing the collected, diffracted X-rays to map the lattice parameter in the polycrystalline material.
22. (Original) A method as claimed in claim 21, wherein the polycrystalline material is a natural material or an engineering material, including a component formed therefrom.
23. (Previously presented) A method as claimed in claim 21, further including:
- (g) transforming the map of the lattice parameter into a map of sub-surface engineering stresses and/or strains.
24. (Previously presented) A method as claimed in claim 4, wherein the energy of the collimated X-ray beam has a range of from 100 to 300 KeV.